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THE C.T.A.'S PUSHBUTTON TRAINS—PAGE THREE

Vol. 8 FEBRUARY, 1956 No. 9

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FEBRUARY, 1956 Vol. 8, No. 9

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COVER STORY

The Houston skyline forms an appropriate background for this aerial picture of the Southern Pacific Railroad Company's new $7,000,000 radar gravity switching yard to be dedicated on Feb. 16, 1956. The new radar yard is the first to be constructed in the Southwest. For more complete information, see page 5.

Engineers-Week, Feb. 19-25

Don't fail to see the display at Commonwealth Edison Co., 72 West Adams St., Chicago.

The meeting of February 28

Free Cocktail Hour
5:15 to 6:15 p.m.

Dinner
6:30 to 7:30 p.m.

Coffee Talk
7:30 to 7:45 p.m.

"Hobbies, Patents and Fun"

By C. A. "Cap" Perz.

"Cap" Perz, speaker extraordinary, will discuss "The Downspout Raincoat," "The Fly-Catching Pistol" and many other patents that are designed for laughter. This talk is humor in big doses.

"The Connecting Channels of the Great Lakes Including the Saulte St. Marie Locks"

By Mr. Edwin W. Nelson, chief, technical assistant and chief, Engineering Division, Corps of Engineers North Central Division—Chicago.

The connecting channels between the Great Lakes, such as the St. Mary's River, the Straits of Mackinac, the St. Clair River and the Detroit River, because of their depths and other physical factors, limit the cargoes that can be carried by vessels navigating the Great Lakes. Despite these limitations, water-borne commerce on the Great Lakes reached an imposing total of 242 million tons in 1953. With completion of the St. Lawrence Seaway, demand for improvement of these connecting channels will be increased. Mr. Nelson will discuss the present connecting channels, their effect on present and prospective water-borne commerce, and results of recent studies for improvement of these channels, estimated to cost in excess of 100 million dollars. He will also discuss the Saulte St. Marie Locks on the St. Mary's River between Lake Superior and Lake Huron.

"Metropolitan Traffic and Transit"

By J. Douglas Carroll, Jr., director, Chicago Area Transportation Study.

Mr. Carroll will discuss the subject of transportation on a metropolitan basis. He will outline the methods of measurement of problems and put forth some thoughts on their solution. Independent thinkers who wish to voice their opinions will be welcomed.

Mr. Carroll and his staff have recently completed a comprehensive study of transportation in Detroit. They are currently embarking on a similar study in the Chicago area.

"Nuclear Reactors in Future Power Development"

By Mr. Andrew Kramer, editor, *Power Engineering.*

Mr. Kramer, author and engineer—member of Atomic Bomb test expedition to Bikini and the Advisory Committee on Technological Information, U. S. Atomic Energy Commission is a graduate of Stevens Institute of Technology. Early in his career he was associated with Commonwealth Edison Co., General Electric Co. and Western Electric Co.

"Rockets and Satellites"

By Kenneth Jacobs, associate chief, Engineering Section, University of Chicago Midway Laboratories.

Mr. Jacobs, President of the Chicago Chapter of the American Rocket Society will discuss the problem of conquering space. The talk will be augmented with slides.

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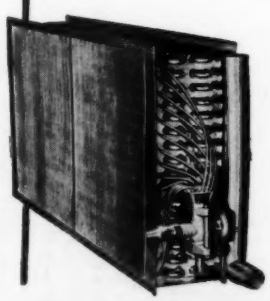

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The C. T. A.'s Pushbutton Trains

By George Krambles

Conducting a transit system serving 4,000,000 population is no small task. In peak hours there will be 300 street cars, 2,900 motor and trolley buses and 1,100 rapid transit cars in service on more than 150 different lines, covering almost 2,000 miles of route. About 8,000 men will be on duty simultaneously.

Possibly no other large industry operates with so little direct supervision of sales or operating help as does the transit business. For example, the Chicago rapid transit system peak operation is supervised by less than 30 people, even though it includes about 175 trains and an equal number of stations with fare collection personnel, these deployed along more than 200 miles of track. Clearly, not much individual attention can be given to each trainman by the ordinary means of sight and voice.

Yet the errors of irregular operation can be very costly to the transit company, but even were this not a problem, elimination of the annoyance and dissatisfaction caused the transit patron would be ample incentive for an unending effort to improve control of operating performance.

Rapid transit schedules are planned to meet the passenger volume requirements of each period of the day, based on actual checks for each 15 minutes of each weekday, Saturday and Sunday. Headways between trains and number of cars per train are varied to obtain the optimum overall result. Although service demands rise to a crescendo with each rush hour and fade away to almost nil in the wee small hours of the morning, the transition is gradual and there is a relatively constant train headway at any one time of the day.

On the very popular North-South route, CTA's principal rapid transit carrier, 8-car trains are scheduled as close as 2 minutes apart and each carries about 1,000 passengers at the maximum load point. Now that this line is completely equipped with new car equipment, the workable capacity of a crowded train is 1,200, so that a deviation in headway exceeding 20% (only 24 seconds) results in overloading that slows a train thus aggravating the gap. A train only a minuate or two ahead or late in this peak load condition will cause a serious disruption of service if corrective measures are not promptly instituted.

Accumulation of passengers at some stations is so rapid as to present the possibility of complete breakdown of service in the event of a delay of only 5 or 10 minutes. Bunching of trains may lead to power failure by concentrating too much rolling stock for the available substation capacity.

Line supervision deals with small service irregularities by controlling the spacing of trains and with major service interruptions by reroutes or turnbacks. It includes new tools for dispatching trains, for recording train operation and for direct voice communication with operating personnel and passengers.

The application of modern relay and electronic methods to the control and supervision of rapid transit service by the Chicago Transit Authority was first reported at a Western Society of Engineers meeting in October, 1951. The original system has now been enlarged several times and covers the entire rapid transit system of Chicago. This article, condensed from Mr. Krambles' talk on the communications section, WSE, on October 25, 1955, brings up to date CTA's line supervision story and indicates where future developments may be expected. Mr. Krambles is operations planning engineer, Chicago Transit Authority.

Can automation be applied in supervisory functions? CTA staff engineer Louis M. Traiser (MW-SE) reasoned that it is one of the most likely places to apply modern mechanical and electronic aids. Obviously the more valuable a man becomes, the more we must do to equip him with information brought in automatically. Every decision that can be made mechanically should be so developed, saving for human decision the complex and unusual.

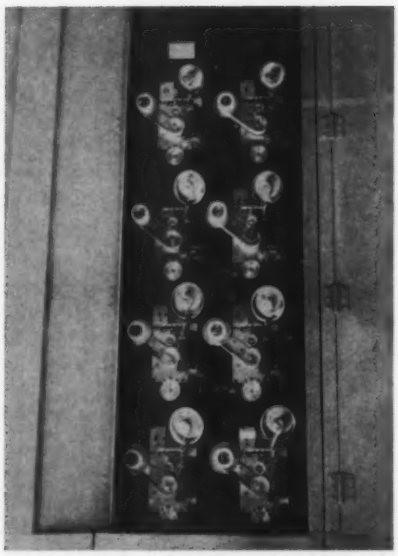
If plans of action for correction of various deviations from normal can be developed in advance and stored ready for implementation, they too can conceivably be executed automatically in some part, once decision for action has been made. This is the advanced direction that has been plotted for Chicago Transit Authority's line supervision system by CTA general manager Walter J. McCarter.

Equipment for Automatic Train Dispatching and Recording

In CTA's recently enlarged rapid transit line supervision system a single highly accurate timepiece at the central office controls the starting of trains from terminals throughout the property. Impulses from this master clock are fed through individual schedule memory tapes (one for each train terminal) to relay units. These units, called automatic train dispatchers, at the exact times established by schedule, turn on starting signal lights observed by train crews.

A graphic recorder system makes a printed record of the precise instant that each train is authorized to leave. Track circuits in the running rails detect the departure of each train and transmit this information through the relay system back to the central office where it feeds into the automatic dispatcher unit to turn off the starting lights. At the same time, the departure is recorded in ink on the graphic recorder, giving a direct indication of the response of the train to its starting signal. Manual control keys permit the line supervisor to modify automatic train dispatcher operation to make corrections for service deviations.

As a train proceeds on its journey, it passes through another indicating track circuit every mile or two and the passing of each of these circuits is recorded on



A group of automatic train despatcher control units governing train starting at 8 different locations on Chicago's rapid transit system.

successive pens on the main office charts. When a train completes a journey, its printed record consists of a series of marks running from lower left to upper right on one of the graphic charts.

Successive trains make similar records, but, since the paper of the charts in the graphic recorders is continually advancing as time passes, the record of each train is made in a different position on the chart. While service is proceeding at a normal interval the chart pips of successive trains are evenly spaced from each other, but should a delay occur the record spacing becomes noticeably uneven.

However obvious a delay might appear to visual inspection, this method of detecting trouble requires too much time and concentration on detail. Therefore, individual synchronous motor or thermal timers are connected to certain key indications. These timers can be set easily to the approximate normal train interval time prevailing at each time of day. If a train fails to arrive at the associated check point within the time setting of the timer, an alarm circuit is closed to energize a warning light on a wall map.

This wall map is a diagram of the track layout of the rapid transit system. Colored lights set into it at appropriate locations are energized to indicate the location and, in a general way, the nature of service deviations that may be occurring. For example, trains ahead of time or late, or interruptions by river bridge openings appear immediately to alert the line supervisor.

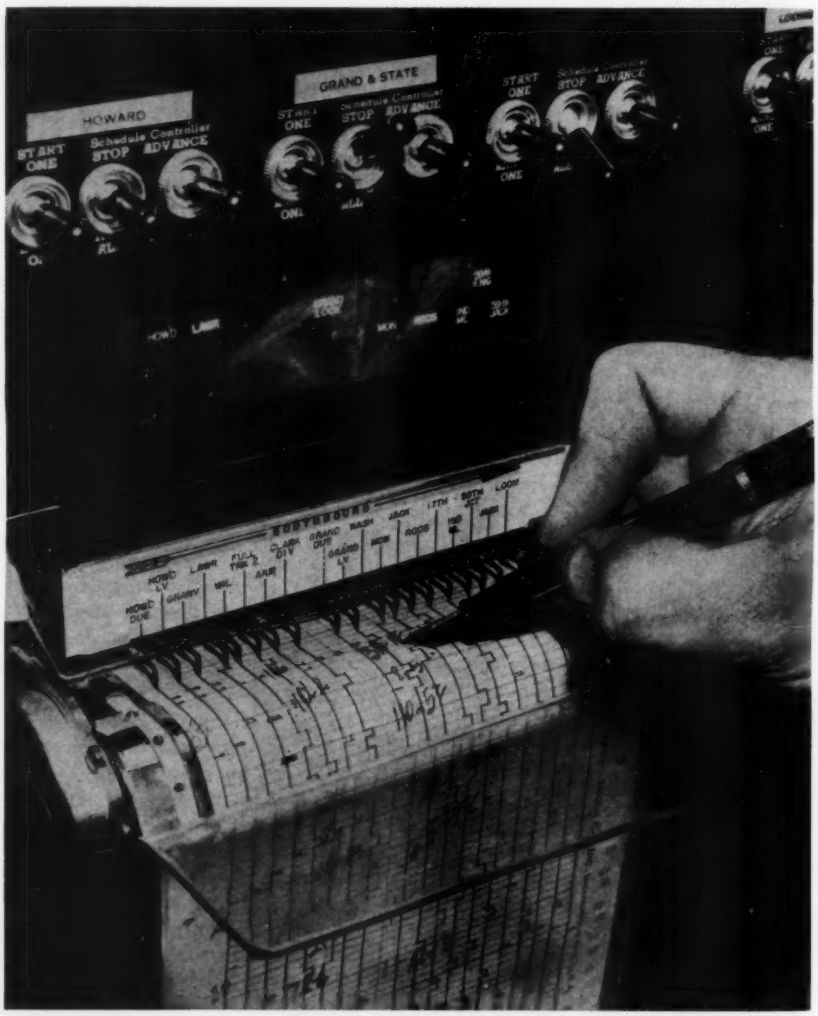
Much thought has been given by engineering assistant Frank J. Misek (MWSE) and his men to organization of the automated supervisory equipment to present the supervisory information in the most useful final form possible and to save split seconds in arriving at the source of trouble. Various colors have been utilized not only in the supervisory lights, but also in the chart inks, controls, labels and designation strips to index sight and thoughts to the problem. Many novel gadgets were developed from basically standard components by CTA power supervisor Edward Wilson so that the mechanical details requiring manual attention of the line supervisor would be as simple and as convenient as possible. CTA engineer Don Worcester (MWSE) put together the initial relay equipment.

Equipment for Communication

Once the location of train service trouble has been spotted, there remains the problems of determining the nature of trouble and placing in effect corrective measures. This phase of line supervision is executed through voice communications, some of them rather novel.

Telephones link up the passenger stations, towers and key personnel, but a highly special intercom system has been developed to meet the unusual needs of speed and priority for split-second rapid transit dispatching. This intercom permits messages to and from the central line supervisor only, with loudspeaker reception at the office and with loudspeaker

(Continued on Page 13)



Detail of one graphic recorder chart and the train despatching controls.

Electronic "Brain" Classifies Cars

In the gloom of night, a heavily loaded steel box car rolls down the "hump" at Southern Pacific's new $7 million gravity switching yard at Houston, Texas.

Suddenly, its trip is slowed. An electronic "brain" that "thinks" and "remembers" has given the directive.

This device recorded the weight of the car, its speed (measured by radar) and the distance it must travel to its place in the classiification tracks below. The "brain" computes the speed at which the car must roll into the proper track to avoid a damaging impact into the car ahead. Automatic "retarders" then reached in from the sides of the rails, squeezed the car wheels and slowed them down.

Ahead, the unseen hands of the electronic brain operate switches that guide the car to its destination. The big freight car curves in and eases gently up to the car ahead.

The use of radar to measure speed, along with a mechanical "brain" to weigh that factor in relation to weight, has turned another chore over to a machine that does not make human mistakes. The era of "electronic railroading" has enabled Southern Pacific to put a car over the hump every 12 seconds around the clock and in all kinds of weather.

Englewood Yard at Houston, scene of this electronic classification, is the key yard of Southern Pacific's Texas and Louisiana lines. It blocks trains for eight sub-divisions that fan out in all directions from Houston in addition to feeding numerous sub-yards and industrial tracks.

Operation of the automatic retarders permits freight cars with varying loads to roll down the hump to any classification track at safe coupling speeds. Adverse weather conditions with poor visibility which would bring conventional push-button yards to a standstill, have no effect on Englewood operations. Piercing radar beams "pick up" the cars as they approach the retarders and set the electronic control circuits for the proper amount of retardation.

An electronic brain was developed to work with the radar speed control. This development literally brought gravity switching into the realm of science fiction. Here the wizard hands of electricity do a giant's share of the work. The tower operator has only to press a button corresponding to the track on which he wants a given car spotted. The automatic switching system and the electronic brain do the rest.

Control of the yard is centered in a three-story tower. On the second floor, the engine foreman routes cars to the various classification tracks by pushing a routing button. The automatic switching machine operates the necessary switches to place each car or cut of cars into the desired classification track. The engine foreman can punch as many as four routes at one time. The machine will remember these and select the designated route for each car as it rolls down the hump.

From the third floor of the crest tower, the assistant yardmaster oversees the entire operation and issues the necessary instructions to keep yard operations moving smoothly.

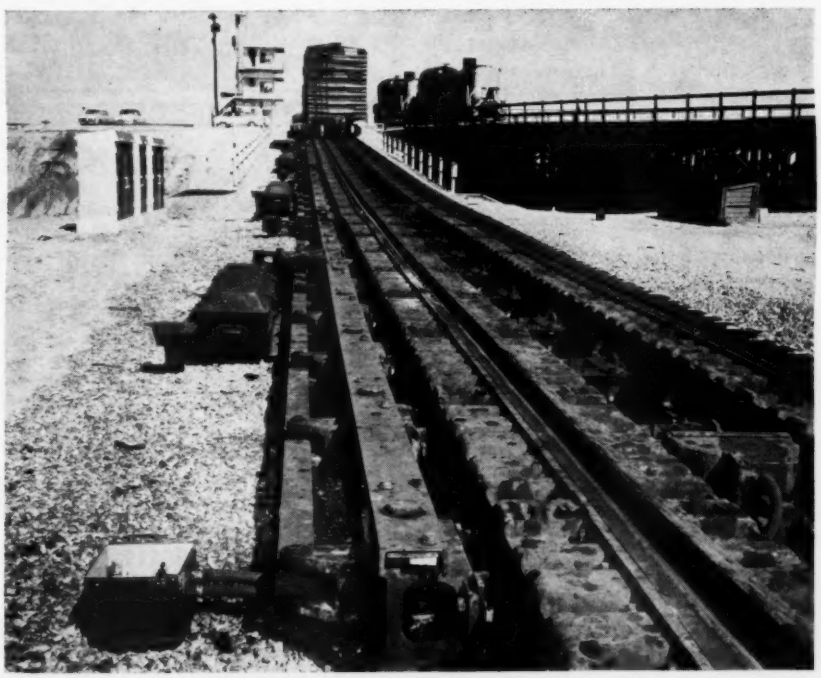
Down on the first floor is the electronically operated automatic track scale. This equipment, manufactured by Cox & Stevens Aircraft Division of Revere Corporation of America, weighs the cars as they roll down the initial three per cent slope of the hump. The scale is 92 feet long and supported by eight load cells.

The entire crest control tower and the 50-foot bowl tower are air-conditioned. The latter tower, located at the emptying end of the classification tracks, is the nerve center of the yard.

Once a car starts down the hump, the electronic brain takes over, guiding and controlling each car. Should the engine foreman make a routing mistake, he can correct this error by pushing a correction button.

The so-called electronic brain, however, does more than remember. It checks on seven different factors regarding the car, its characteristics and the distance each car must roll.

First of these factors is car weight. This is important, because heavy cars have different rolling characteristics from



A freight car moves towards the classification track. Radar determines the car's speed and relays it to the equipment that controls the braking action of the retarders.

This article is reprinted from the August, 1955 issue of Modern Railroads.

empty equipment. The secret of the uniform flow of cars of varying weights down the hump is a weight detecting device located immediately ahead of each retarder. This equipment consists of a treadle working against a heavy spring so that the amount the treadle is depressed depends upon the car weight. Electrical contacts report back to the "brain" whether the car is light, medium or heavy — sufficient information for guidance of the retarder.

The second factor which the brain must know in order to control the retarders is how fast the cars are rolling. An automatic retarder control accomplishes this instantaneously. At the end of each retarder a radar antenna focuses a searchlight-like beam of ultra-high frequency waves toward the approach end of the retarder. As a car enters the retarder, the beam strikes the approaching car and some of the waves are reflected back to the antenna unit, technically known as the interferometer. Because the cars are moving, the frequency of the reflected waves are slightly different from the signal frequency. The difference constitutes a measure of the speed of each car.

The electronic brain interprets this deviation of frequencies and instructs the retarder mechanism to release the car at the optimum speed. The radar operates effectively through fog or the darkest night. A total of 18 radar antennas are used, one each for the six sections of the master retarder, and two for each of the six two-section group retarders. Each group retarder pair serves eight tracks.

The most difficult problem for the electronic "brain" however, is the determination of the optimum release speed. At this point the electronic computer section comes into action. It must consider the rollability of each car and the track resistance which the car will encounter on the route selected. The latter is an important factor for just as no two cars roll alike, no two tracks offer the identical resistance. Some tracks are longer and have greater curvature than others. The electronic computer also watches for long "cuts" involving several coupled cars routed to the same classification track.

The electronic computer determines rollability by checking the gain of speed for each car from the time it is released from the hump retarder to the time it enters the group retarder. Simultaneously, the automatic switching system tells the computer what track the car is bound for. The computer feeds this information into the "brain" which determines the speed at which the car is to be released from the group retarder. With the continuous control possible with radar, the electronic brain is in touch with the car as long as it is in the group retarder. Thus, as the car slows down in the retarder to a speed near the correct value, the "brain" tells the retarder to ease off a bit. Then when radar tells the "brain" that the car is rolling at the correct speed, it releases the car which moves into the yard at a safe coupling speed.

Several factors, however, remain under the control of the retarder operator whose headquarters are in the power and retarder equipment control tower. When necessary, he operates the weather control that regulates the car release speeds required to meet exceptional climatic conditions and other factors affecting the rollability of the cars.

Because of the location of the Englewood Yard it was necessary for Southern Pacific to locate the hump east of classification tracks, and directly over the main tracks of the Houston Belt & Terminal Railway. This necessitated a 27-ft. high crest with a 5.9 per cent grade.

Additional problems resulted from a city requirement to permit ample clearance for two double lanes of superhigh-

(Continued on Page 15)

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A. R. F. Starts New Construction

A $5,000,000 building program was announced Jan. 10 which will give Armour Research Foundation of Illinois Institute of Technology " one of the most complete industrial research centers in the world."

The expansion program calls for the construction of three buildings and substantial additions to buildings over the next 10 years.

The plans were outlined by Dr. Haldon A. Leedy, Foundation vice president and director, at the University Club at a press dinner kicking off ARF's 20th anniversary observance.

"The building program is a necessity if Armour Research Foundation is to meet the increasing demand for its industrial research and development services," he stated.

Leedy said ARF expects to have a 50 per cent increase in research volume and personnel within five years.

"The building plans are based on the assumption that the Foundation will have a research volume of $16,000,000 and a staff of 1,600 by 1961," he explained.

New buildings planned and their dates of completion follow:

—$1,250,000 Physics and Electrical Engineering Research building at 3400 S. State street (now under construction), 1956.

—$1,500,000 Chemistry Research building at 35th and Dearborn streets, 1959.

—$1,400,000 administration building at 10 W. 35th street, 1966.

Additions scheduled are:

—$550,000 addition to the Mechanical Engineering Research building at 3422 S. Dearborn street, 1961.

—$300,000 addition to the Metals Research building at 3350 S. Federal street, 1961.

The five construction projects will consolidate, modernize, and enlarge Armour Research Foundation's physical plant, now scattered over 15 buildings on the Illinois Tech campus, according to Leedy.

"When completed in 1966, the Foundation's facilities will be concentrated in six buildings in a two block area," he asserted.

The buildings will include the five involved in the expansion and the Engineering Research building, built in 1945, at 55 W. 34th street.

All of the new buildings will be of a functional nature and similar to the others designed by Ludwig Mies van der Rohe on the Illinois Tech campus, he said.

Leedy reported that the Foundation's research volume surpassed the $10,000,000 mark for the third consecutive time during the 1955 fiscal year, ended August 31.

"It also was a year in which ARF performed research and development in connection with more industrial projects than ever before—a record 342 projects. In addition, the Foundation handled 170 projects for the government," he pointed out.

In reviewing the year, Leedy said outstanding contributions were made by the Foundation in such varied fields as aerosol technology, titanium alloys, blast protection, and ceramic coatings.

Other highlights included the creation of an engineering economics research department, expansion of the licensing program, and start of construction on the nation's first private nuclear reactor for industrial research.

Leedy said a number of events will be sponsored by Armour Research Foundation during 1956—its 20th year—to show the importance of industrial research to the nation.

One of these events will be the first annual National Industrial Research conference at the Sherman hotel in Chicago on April 18 and 19.

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Unions: For Engineers?

(Reprinted from the *Missouri Shamrock*)

Recently we have received some literature on the subject of unions for engineers. Apparently quite a bit of this type of material is being mailed to colleges in the hopes of swaying the student of engineering in favor of engineering unions. One letter in particular was quite interesting to us; it was an excellent example of techniques used in all sorts of organizing campaigns. At one point it said ". . . over 40,000 of the country's engineers and scientists currently enjoy the economic and professional advantages of collective bargaining."

This is the old "jump on the bandwagon, everybody's doing it" technique. Unfortunately, the letter failed to state just what are the advantages of collective bargaining *for engineers.* The writer of the letter signed it "Fraternally yours . . ."; and after his name listed his college, year of graduation and three Greek letters, apparently a social fraternity to which he belonged. In the body of the letter it was stated than many of the officers of this particular union were former fraternity men. The letter further stated that "it is planned to mail material at regular intervals to the various social fraternities." This all adds up to another well worn organizing technique — identifying yourself with your audience.

We are somewhat curious as to what the logic is in choosing a social fraternity as the prime target for union literature. Most of the social fraternities have a pretty good sampling of students from every branch of learning. Material mailed to them will reach a relatively small segment of the engineering enrollment. This is unfortunate, inasmuch as the union literature is one of the most convincing arguments in favor of *not* joining an engineering union.

One thing which is usually lacking in union literature but is much in evidence in union contracts is the word "seniority". This single word represents one of the most significant and destructive concepts in our society. It is a poor substitute for initiative, ability and hard work.

In many industrial organizations, management has resorted to incentive payments for union workers who no longer have any competitive spirit; it is interesting to speculate on how they would contrive to "induce" a competitive spirit in the unionized engineer.

America is currently in the grip of a shortage of Engineers. The shortage, according to Ass't. Sec'y. of Defense Donald Quarles constitutes "potentially a greater threat to national security than any aggressor weapons known." (November 1955 TIME magazine.) The surest way to make this shortage more acute, and to jeopardize American freedoms, is to eliminate the "American system" of competition in the professions and to unionize the Engineers.

P.D.G.

Radiation Sterilization Appears Far Away

Sterilization of foods by nuclear radiation isn't just around the corner.

This popular belief was shattered by Dr. Leonard Reiffel, supervisor of nuclear physics at Armour Research Foundation of Illinois Institute of Technology, Chicago.

"There has been a great deal of talk about radiation sterilization," he said in a year-end statement, "but the hard facts are that it doesn't look possible for the near future, at least."

"And for one good reason," he added. "Radiation sterilized foods taste, smell, and look terrible!"

"Certainly one of the most exciting possibilities of the 'atomic age' is the sterilization of foods by radiation," declared the physicist.

If this could be achieved, refrigeration would be a thing of the past and storage life of meats and vegetables on ordinary pantry shelves would be very long indeed."

What does seem possible, according to Reiffel, is radiation pasteurization—killing most, but not all, the bacteria. This requires much less radiation, does not destroy food quality, and still lengthens storage life under refrigeration.

"In other words," he said, "one can expect processes using a combination of mild irradiation and refrigeration to be a really important upcoming contribution of nuclear technology to man's well being."

Although this is not as spectacular as meat lasting forever at room temperature, it is considered a tremendously important advance.

Radiation retarded spoilage will present fewer shipping problems, provide a supply of seasonal foods throughout the year, and enable greater utilization of surplus foods.

"This is possible right now with present knowledge," Reiffel stated, "and 1956 should see actual trials of the method for some products, at least."

Aside from food preservation, he predicted that 1956 will see the completion of three or four important power producing reactor prototypes. By the end of the year, the present wide choice of power reactor designs is expected to begin to narrow down a little.

Important developments of peacetime uses of atomic energy are expected to occur in 1956 when eight research reactors are scheduled to go critical. Among these is Armour Research Foundation's reactor, the first private reactor constructed for industrial research.

Production of new plastics will be expanded, research on radiation induced chemical reaction in petroleum and other fields will gain momentum, medical research will continue to pick up more tools of physicists to use in its own research, and an evaluation of radiation hazards in outer space will be possible, Reiffel predicted.

"In more fundamental nuclear studies," he said, "the exciting subject of the existence of the 'anti-proton' and other strange fundamental building blocks of matter and the development of the new, tremendously powerful, 'strong-focusing' accelerators probably will occupy the center of the nuclear stage."

Wood Craft Seem Here to Stay

The U. S. Navy had 50,000 wooden craft in its two-ocean fleet of World War II and it's been adding new wood vessels constantly since the war's end. As a matter of fact, sea-going ships have been built of wood for 4,000 years. A 3,800-year-old, 32-foot boat of heavy cedar planks is one of the top attractions at the Chicago Museum of Natural History.

Smith Urges More Attention to Utility

Architects spend too much time worrying about buildings' aesthetics and neglect the practical aspects, O. G. Smith, MWSE, chief engineer, Illinois Bell Telephone company, charged.

He said building designers make sure there is adequate provision for such modern conveniences as air conditioners, but forget to take into account communications systems.

"We don't like to drape wires and cables all over the place," Smith commented, urging architects to devote more consideration to practical problems.

Exterior maintenance, he contended, begins on the drafting board at the time of the selection of design, materials, and construction methods.

The need for more coordination between building designers and building operators was emphasized at the conference.

Roy H. Krueger, vice president, Browne and Storch, Inc., property managing firm, cited the need as he discussed interior maintenance.

No one knows the good and bad points of apartment and office buildings better than their occupants, Krueger explained. Building designers and operators, he added, must cooperate and communicate in order to correct the deficiencies.

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Memory Has Complete Reliability

For the first time in electronics history, International Telemeter Corp. announced in Los Angeles in December, a high-speed computer memory has operated with absolute reliability. During the first six months of operation, the memory "has memorized information equivalent to over 100,000,000,000 letters without making a single mistake." The memory, which operates on a new principle, furnishes a new tool for automatic computation and automation.

Telemeter's memory, which was installed in the Rand JOHNNIAC Computer over six months ago, stores its information in 163,840 tiny magnetic cores. It is able to reach any item of information in its store in less than 5 millionths of a second, and can memorize and read back the equivalent of 50 novels a minute.

During the past six months, the memory was engaged in actual computation for 1,070.43 hours. Its "mean free time" was 59.5 hours. Mean free time is a measure of the average time that the computer is able to run without having to be shut down for maintenance work. Since the average mean free time of earlier devices which performed the same function was about five hours, the Telemeter magnetic memory can be said to have been more than ten times as reliable as anything used before. As part of the Rand JOHNNIAC Computer, the memory is now helping to solve scientific problems which were once thought to be unsolvable because of their extreme mathematical complexity.

To perform complex operations, large automatic computers need units in which information can be stored. The information is inserted in the unit at one stage of an operation and removed when it is needed at some later stage. These units are called rapid access memories. Since the computer may perform an arithmetic operation in a few millionths of a second, it must be possible to store the information and to get it out in extremely short times. The memories function as high speed scratch pads for the computers.

Various devices, both electrostatic and magnetic, have been used for this purpose. The principal trouble with electrostatic devices is that it is difficult to keep information stored in them. The stored energy tends of itself to decay rapidly and must constantly be put back into the memory. Furthermore, electrostatic devices are not rugged and impose certain limitations on the way in which mathematical operations can be performed.

The delay line, in many ways an ideal rapid access memory, has a very small capacity. As in the electrostatic store, information disappears if it is not repeatedly restored. Like magnetic drums, the delay line delivers the stored items of information in a fixed sequence, and the computer must wait for the item it needs to appear in the sequence.

Most popular of the magnetic devices have been magnetic drums. Information is stored on these drums by magnetizing small areas of the surface of the drum and not magnetizing other areas. As the drum is rotated, reading heads, similar to the pick-up heads on magnetic tape record players, picks up patterns of dots and blank spaces, and electronic circuits decode these patterns of dots and blanks into the information stored on the drum. The code is comparable in principle to the Morse code used in telegraphy and radio communications.

The trouble with the drum is that, since it has to rotate to the spot where the desired information is located, it takes relatively long to get at any one item. Furthermore, the drum is a mechanically rotating part, and, as such, its life and efficiency are limited.

Ferrite cores eliminate these difficulties. The Telemeter memory, made of them, has no moving parts and permits reaching of any item of information directly without waiting for unwanted items to go by. The use of these cores entered the experimental stage about three years ago.

The cores themselves look like tiny doughnuts with an outer diameter of a tenth of an inch. They are made very much as other ceramic goods are by molding and baking a clayey mixture of iron, magnesium and manganese oxides.

The cores are strung on copper wires on a series of frames, about eight by sixteen inches. Two wires at right angles to each other pass through each core. There are 4,224 cores on a frame and 40 frames in the Telemeter memory.

Information is stored in each core by magnetizing it with either positive or negative polarity. Magnetization is accomplished by sending currents through the two wires which pass through a core. Reading (getting the information out of the memory) is accomplished by sending currents through the core, which change its polarity of magnetization. As its polarity changes, it induces a current in a reading winding which links all cores. The reading currents from a series of cores are decodable by electronic cir-

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cuits in the computer into the information. The code, as with the magnetic drum, is similar to the Morse code in that it consists of a pattern of pulses. A core magnetized with a certain polarity will yield a pulse; a core magnetized with the opposite polarity will not.

Similar memories are being completed for the Argonne National Laboratory, the Ballistic Research Laboratory of the Aberdeen Proving Grounds, among other places. Work is currently under way on a memory several times the size of these for the Wright Air Development Center.

Will Coal Be a Birth Stone Next?

A New York jewelry designer has produced anthracite earrings and cuff links as examples of what can be done with "black diamonds," according to *Coal Age*. Hard coal is more than 90 per cent pure carbon, making it a close cousin of the 100 per cent carbon white diamond. Heretofore, the beauty of hard coal as a "semi-precious stone" has been untapped.

Better than Gold!

They're using stainless steel for money down in Costa Rica, where it's claimed the new five- and ten-cent pieces not only look pretty, but outlast all other coins, *American Machinist* says.

Capital Investment Reaches High Figure

A total capital investment of 175 billion dollars was necessary in 1954 for the operations of America's manufacturing corporations in order to produce goods and keep people employed, according to a report prepared by the National Association of Manufacturers' Research Department from government statistics and released in Chicago.

The report pointed out that 66.4 billion dollars of this total capital investment represents the manufacturing plants, the land on which they rest, and the machinery and tools within the plant.

"What is not generally realized," the report states, "is that manufacturing companies have to keep an even larger amount invested in what is known as 'current assets' — inventories, receivables, and cash. This type of investment is indispensable to the conduct of a manufacturing business."

The total amount invested in inventories at all stages came to 43.3 billion dollars at the end of 1954, the NAM report continued. These inventories consist of a stock of raw materials, a stock of partially finished goods, and a stock of finished products. Inventories are kept, not because manufacturers like to see a stock of goods piled up, but because it cannot operate without them.

Another portion of the total capital investment of 175 billion dollars consisted of 23.8 billion dollars which represents receivables—the amount owed by customers on the orders they have received but not yet paid for at the end of 1954. In effect, due to the custom of selling goods on credit, manufacturing corporations had loaned this amount to their customers.

On Dec. 31, 1954, manufacturing corporations held 28.0 billion dollars in the form of cash or U. S. Government bonds, which is the last major part of the total capital investment. This may seem like an enormous "hoard" of ready cash, but the conduct of any business requires a substantial fund of cash, or assets readily convertible into cash, be held at all times to meet essential expenditures of various kinds.

Chemical Battery May Keep Usefulness

The chemical battery may never be challenged by the nuclear battery, but the latter may find wide application as a power source, it was reported in New York on Feb. 1 during the Winter General Meeting of the American Institute of Electrical Engineers. The observation was made by William Shorr of the Signal Corps Engineering Laboratories during a symposium on research.

"It is not believed that the ubiquitous chemical battery will ever be seriously challenged by the nuclear battery," he observed in a paper describing the Signal Corps' investigation into isotopes to furnish power for nuclear batteries.. "The minute amount of power (of the order of microwatts) presently available from the nuclear battery will limit its application to those areas where the intrinsic characteristics of the nuclear device would be used to the most advantage. With the further development, however, of more effective radiation shielding materials which would enable the use of greater source activity and greater improvement in the conversion efficiency of radiation energy to electrical energy, it may be possible to broaden the power output range by a magnitude or more."

Nuclear batteries are a source of continual voltage and current in a compact and portable size, have a very long life and are inherently insensitive to extremes of temperature, pressure variations and strong electric or magnetic fields, he reported.

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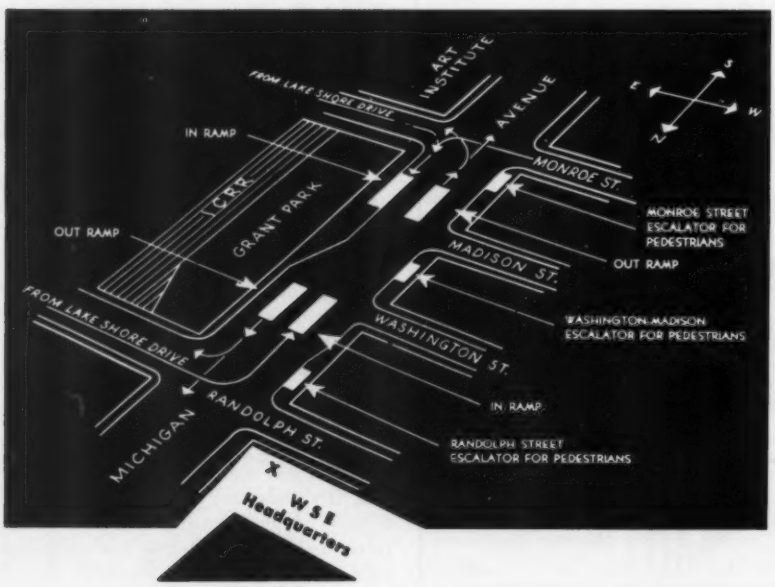
Below: map showing Park Department Underground Garage



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Pushbutton Trains

(Continued from Page 4)

and microphone operation at the way stations. The stations on the intercom system are grouped on party lines radiating in three directions from the central office. Each party line consists of two pairs of telephone wires, one for messages going outward; the other for messages coming inward.

A selective call system permits the line supervisor to dial the particular station he wishes to communicate with, but a person at an outlying station need only press momentarily a call key to contact the line supervisor. Modern automatic limited circuit electronic amplifiers are used throughout to give optimum results without precise training of personnel or frequent control readjustment on amplifiers. Operation techniques for this intercom apparatus more nearly resemble commercial radio practice than telephone practice, with ringing replaced by direct voice calling.

Another novel feature of this communication system is the inclusion in it of platform paging equipment at 42 important rapid transit stations. Any one of these stations can be "dialed in" by the central line supervisor and announcements made by him will be clearly distributed over the entire area occupied by the maximum length of train used. Ingenious modifications of the basically simple impulse-type selective calling unit worked out by CTA engineer William C. Janssen resulted in substantial equipment economies by permitting two to six nearby train platform paging systems to be operated from a single set of call and amplifier controls. The line supervisor talks out on any one of the platforms he wishes by simply dialing appropriately.

This junction is entirely automatic in operation, with trains passing here recorded instantly at the Central Office.

Timing of such announcements to correspond to the appropriate train is easily established by line supervisor from the graphic recorder charts which show when a train arrives and when it leaves each of the platforms equipped with loudspeakers.

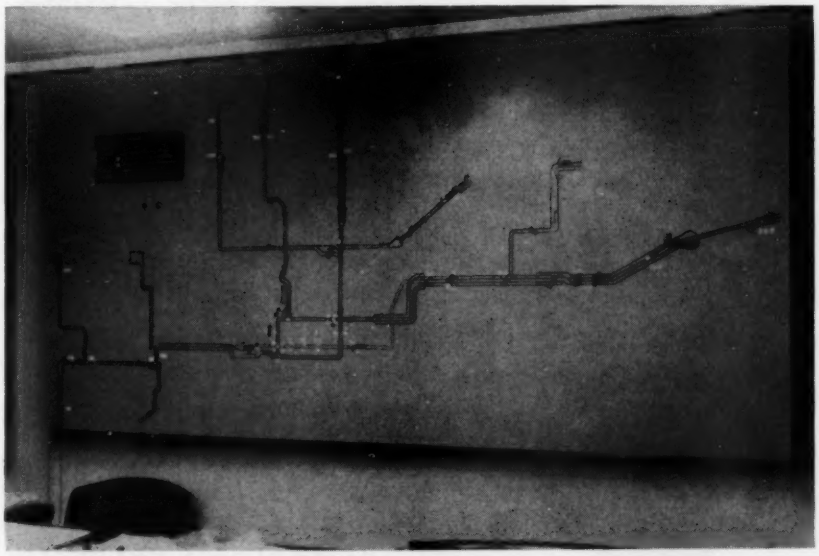

Diagram board with colored lights which indicate train operating conditions.

Line Supervision in Action

Techniques for operating this novel equipment to obtain unusually effective results were worked out by CTA rapid transit assistant operating superintendent John F. Higgins and the several line supervisors who participated in its initial phases.

In actual operation the line supervisor observing a delay, immediately arranges for a field supervisor to meet the troubled train. Simultaneously, he corrects for the effects of minor delays by spacing trains. In this technique, he will deliberately shift the time of one or more trains preceding a late train to divide the original delay to one train into smaller delays for several trains such that an equal, though greater than scheduled, headway results. This technique can be used if there is on the road one or more trains ahead of the delayed train and yet back of a suitable control point in advance of the heavy boarding passenger load. It cannot be used when, even with the final spacing, there would be overcrowding to the point of breakdown.

A more drastic, but far more effective correction can be applied by running the delayed train express past certain scheduled stops in order to surpass normal running time and to avoid the overcrowding which would result from

attempting to load passengers for whom there may be no space. Moving the delayed train out of the way permits more lightly loaded trains to move up promptly for passengers at stations passed by the express. Bringing the delayed train more nearly back into proper position practically eliminates the chances of the delay to it enlarging to the point where its next return trip cannot be started on time.

The "running" maneuver is effectively executed by the line supervisor through the use of the platform paging loudspeaker, timing announcements by referring to the graphic recorders and by monitoring the background noises through the intercom equipment. Considerable attention is, of course, given to the diction, phraseology and tone of voice of announcements heard by the public since these factors can greatly improve the confidence with which the line supervisor's work is accepted.

The value of the supervisory and communication equipment is greatest on those rare, but inevitable occasions when some emergency (such as a serious fire adjacent to the rapid transit right-of-way) causes a complete blockade and necessitates emergency routing.,

Future Applications of Automation

Additional needs of the line supervision system center mainly around some accurate means of identifying and describing exactly trains at a station served by more than one route. Television, as well as relay systems are being considered. One method developed by CTA signal engineer Charles A. Butts (MWSE) has been under actual successful test at Lake and Paulina Junction for more than a year. It involves an 80 kc. low power radio frequency signal beamed across the track by a fixed wayside unit. When intercepted by a suitable doughnut-shaped coil carried on one of two kinds of trains to be identified, resonance is produced and detected by a receiving antenna at the wayside location. This momentarily actuates a relay which encodes track circuit information to identify the passing train as being destined to the Douglas route.

This information is then fed to an unattended, all-relay, interlocking plant which routes the proper train automatically to the Douglas route, in full safety, taking into account the fact that the diverging track must cross at grade over the inbound track of the Lake route. An outbound train of the Lake route, not carrying the car coil, actuates the track circuit but not the radio circuit and this establishes its route through the interlocking to the Lake line. The system, though effective, is yet too costly in its present form for general application in the line supervision system.

Extension of line supervision techniques to surface operation is retarded by the magnitude and complexity of the surface operation and the difficulty of positively identifying rubber-tired transit vehicles in the hodge-podge of a typical stream of mixed street traffic. However, CTA is attacking this problem and has assigned Ralph W. Tracy, transportation engineer, to the development and test operation of a suitable, relatively inexpensive device for that purpose.

The value of line supervision in dollars is difficult to prove exactly—who can say what delays we would have without it? Nevertheless, it is accepted that the entire capital outlay for the rapid transit portion was returned by out-of-pocket savings within the first year. For example, at least 28 to 30 additional cars, worth nearly $1.5 million at today's prices, are saved through ability to fit capacity more closely to demand and by reductions in running time allowed at terminals to protect return service against delays. It has played an important part in enabling the rapid transit to attract increasing patronage in the face of a downward trend to transit patronage generally.

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"Brain" Classifies Cars

(Continued from Page 6)

way. To meet all of these conditions, the main crest was located on a concrete and steel ballasted deck structure.

The new yard has three tower structures and 24 miscellaneous buildings. In addition to the crest control tower and the power and retarder equipment building, the yard includes the general yard office, interlocking control tower, inspection stations and five large locker rooms. All key buildings are air-conditioned.

Ample communication facilities have been provided. There are 38 paging speakers and 238 talk-back speakers in the yard, manufactured and supplied by Electronic Communications Equipment Company. To serve these, 31 miles of underground communication cables criss-cross the area.

The communications system also includes a bank of six Teletype machines, a PAX dial telephone system, Ampex Electric high fidelity recording equipment and a full complement of PBX telephones.

Checkers stationed at all entrances to the receiving tracks read off the initials and numbers of each car in the train as it passes the checker station. This information is recorded on an automatic tape recorder in the general yard office located near the crest. From this and other information already in the yard office, switch lists for each train are prepared.

In addition to the electronic communication facilities, a pneumatic tube system of 6-inch tube and 6,000 feet of 3-inch tube carries waybills between key points in the yard.

All switching locomotives working in the yard are equipped with two-way radio, providing open channel communication between engine crews and supervisory personnel.

Block signaling and interlocking systems have been provided for key points and trackage. Under the interlocking systems, eastbound entering switches are all power operated and controlled by a tower operator. All receiving tracks are equipped with signal track circuits with track occupancy panels located in the interlocking and crest towers to indicate clear tracks.

On a track-side panel, the yardmaster flashes the track number on which he wants west bound trains to enter the receiving yard.

The yard also has a ground level inspection station. It is positioned so that eye-level of the car inspector is at rail level. There is also a high level station from which the tops of the moving cars can be inspected.

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The Citizens of Concord, Mass. Win Bridge Battle

The citizens of historic Concord, Mass., have won a battle to have their storied bridge restored in wood. The original wood structure, famous as the "rude bridge that arched the flood," was the scene of the opening engagement of the Revolutionary War. British troops were met at the span by Colonial Minutemen who fired the "shot heard 'round the world."

Years later, the wood bridge was replaced by a steel and concrete structure. Then, recent floods destroyed the steel and concrete span. Concord's citizenry protested loudly against proposals to erect another steel and concrete structure. Now, the state commissioner of Public Works has promised that the bridge will be reproduced in wood and made as durable and storm resistant as one of other materials.

Pleads for Information Exchange

A plea for the international exchange of technical information was sounded at the meeting of the European Investment Casting Industry at Zurich, Switzerland, by Ted Operhall, president of the American Investment Casting Institute, and Charles W. Schwartz, technical director of the Misco Precision Casting Company.

In a prepared paper, delivered by Walter Sulzer of Switzerland's Sulzer Brothers, Ltd., Operhall, who is also president of Misco, told the European delegates that "to keep pace with the new fields opened to our industry, there is a real need for the free exchange of technical experience. It is too time consuming and costly for any one company to attempt alone the vast amount of research necessary to keep abreast of these new developments."

The Americans then explained the formation of the Investment Casting Institute and the many things that it has accomplished for the American industry since its formation in December, 1953. They discussed the development by the American Institute of industry standards for metal specifications, dimensional tolerances, testing procedures and process materials and the various educational and promotional programs so that designers and engineers would learn the many beneficial attributes inherent in the investment casting process.

"Members of our Institute were interested in determining which fields in order of importance were being currently supplied with investment castings," Operhall said. "The Institute conducted such a survey and found that our process was supplying components for jet engine blades and vanes, aircraft instruments, business machines and tabulators, construction machinery and equipment, electronic devices, farm equipment, food equipment and machinery, non-aircraft instruments, home appliances, machine tools and equipment, portable and pneumatic tools, turbines, compressors, pumps, the railroad industry and the textile industry.

"Although our industry can serve an infinite number of fields, many of us believe that the gas turbine field is our forte. As we once embarked into the production of the reciprocating engine, we now stand on the threshold of 'the gas turbine.' Within the next five years the industry anticipates a wider use of investment castings in gas turbines, not only for military aircraft but for personal planes, automotive, bus and truck applications," Operhall said.

Schwartz explained to the delegates that "modern investment foundries also are investigating vacuum melting equipment which can be put into semi-production operations in the hope that alloys which do not require strategic metals can be used. Air cooled engine components also are being studied. Because of the complexity of configuration and cooling channels of these parts, it is expected that they can be produced as investment castings.

The tremendous fields that will be generated by these applications will require untold quantities of airfoil castings," Schwartz stated.

Operhall concluded with the statement of the necessity for the exchange of knowledge.

"Only by pooling technical knowledge and skills will we be able to take advantage of the many new avenues opening to our industry and thereby reach our full potential. If you gain nothing else from my speech, you will leave Zurich with full knowledge that the investment casting process in the United States has the same problems as you have here in Europe. But through continued research, development and cooperative effort, we will learn to utilize this process to its greatest extent and efficiency," he concluded.

Tool Engineering Attracts Attention

Unprecedented interest in tool engineering advances has resulted in record-breaking demand for exhibit space at the 1956 Industrial Exposition, sponsored by the American Society of Tool Engineers and scheduled for Chicago's International Amphitheatre, March 19-23.

"With applications for space still coming in more than a month after the original area allotted to exhibits was sold out, we were forced to open the Amphitheatre's North Hall to take care of the rapidly growing waiting list," Harry E. Conrad, ASTE Executive Secretary, said in outlining the details of the Exposition. "Some additional space is being made available on a first-come, first-served basis after the waiting list has been assigned, but even this may not be sufficient for the new applications coming in. Exhibitors are requesting more space this year than in any previous show with the increase averaging 12% per exhibitor."

Opening of the new hall makes the 1956 "Tool Show" the largest ever held in the more than 18 years ASTE has been staging its expositions for industry. More than 40,000 registrants are anticipated, according to Conrad.

New developments to be shown will carry out the "Tooling for Tomorrow" theme and include the latest ideas in cutting tools, ultra-fast and extreme precision machine tools and accessories, processes and workholding devices—many of them never before shown publicly to industry.

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cal advances and production problems will feature some of the nation's outstanding experts in the fields of automation, precision control, plant management, cutting, grinding and other phases of manufacturing. Many of the Society's 32,000 members as well as thousands of non-member production engineers and management executives are expected to attend these conferences and the exposition.

The technical program topics cover a broad range of new manufacturing practices, research and development. Included among the subjects will be latest developments in the use of ceramic cutting tools, the new "wonder" material which may boost tomorrow's cutting speeds to 7,000 surface feet per minute. Where ceramics show promise and where they appear to have definite limitations will be discussed in detail.

Plastic tooling, ever increasing in diversity of applications because of production cost reductions, ease of handling, etc., will be covered by four top industry experts. Practical and proven uses as well as new materials and methods are sure to interest most production men.

Two papers will outline the uses of a new automation tool for tool engineers—the electronic calculator or "brain." Almost any sequence of machining operations can be fed or "programmed" into these units, which then will automatically control the machine to produce a finished part.

The Diamond Symposium, co-sponsored by Armour Research Foundation of Illinois Institute of Technology, will shed new light on possible applications of diamonds in industry as well as present actual experience with diamonds in production in the United States and other countries. A complete shop actually producing diamond tools will be in operation. Displays of man-made, gem and industrial diamonds—valued at several million dollars—will be exhibited.

Other subjects to be covered by technical papers and panel discussions include: working the "wonder" materials, new developments in grinding, automating individual machines, carbide dies, fine pitch gear production, jig and fixture design, fluid power, cost reduction through product and tool maintenance analysis, and tooling the world's largest presses.

Armour Research Has New Computer

A new high-speed digital computer has been added to the computation facilities at Armour Research Foundation of Illinois Institute of Technology, Chicago.

The device—an IBM 650 magnetic drum data-processing machine—gives the Foundation the most complete scientific and engineering computation services in the Midwest.

It will enable ARF engineers, mathematicians, and physicists to consider a wider range of problems than had been possible with previous equipment, according to Harold H. Kantner, supervisor of mathematical services.

The IBM 650 has been installed in the Foundation's Computer Center housed in the Electrical Engineering Research building, 3201 S. Michigan avenue.

It is a stored program, modified single-address, numerical decimal machine with a memory capacity of 20,000 digits, Kantner explained.

The machine has all the advantages of stored programming, high component reliability, self-checking, automatic operation, compact design, and ease of operation, he added. Because of its great flexibility, it serves the needs of accounting, engineering, and scientific computing fields.

The ARF Computer Center is a facility for solving problems where manual computation techniques are too time-consuming or cannot be applied.

Since its establishment in 1950, the center has continued to expand until today it operates an impressive array of analog and digital computing equipment. Two Goodyear electronic differential analyzers comprise the basic analog equipment and the new IBM 650 will provide the core of the digital computing facilities.

The Computer Center staff cooperates with other sections and departments of the Foundation and with other organizations at Technology Center to solve a wide variety of problems for business and industry and for scientific research.

These problems include chemical process development, servomechanisms and control systems, production scheduling, operations research, information processing, statistical analysis, heat transfer, acoustics, optics, vibrations analysis, aerodynamics, stress analysis, thermodynamics, and wave analysis.

In addition to using the new computer for work arising from research projects at Technology Center, the Foundation will make machine time available to business and industry in cases where the problem already has been formulated for the machine.

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All Aboard—Have Charge Plates Ready

A unique "ride-on-credit" plan recently has been put into effect by the Virginia Transit Company—probably the first time in history that a transit rider could use his department store charge account to buy a seat on a mass transportation vehicle, says *Bus Transportation*. The plan makes available bus ticket books which can be purchased at certain department stores where customers can charge the books on their store accounts.

Guide Popularity Results in Reprinting

The very great popularity of the third edition of "Typical Designs of Timber Structures," longtime standard guide used by architects and engineers in planning light and heavy wood structures has necessitated a second printing by its publishers, Timber Engineering Company, research affiliate of the National Lumber Manufacturers Association.

Since its inception in 1942, more than 100,000 copies of the guide's three editions have been distributed, without charge, on individual requests from designers. Timber Engineering attributes the heavy demand, that quickly depleted the third edition's first printing in 1955, to the increasing use of wood roof trusses in homes, schools, churches, and commercial and industrial buildings.

The third edition contains 102 typical designs that illustrate suggested methods of applying the Teco timber connector system in wood framing for the more commonly encountered structural problems in timber roof trusses, bridges, towers, hangars, grandstands, and farm buildings.

More than half of the designs were developed especially for the third edition; the others are revised designs that reflect new technical data and developments in engineering and construction techniques that have occurred since issuance of the second edition in 1948.

The third edition's typical designs were selected from hundreds developed by Teco as one of its free services for designers in wood. Included are suggestions for pitched, bowstring, flat, and Lank-Teco roof trusses; Teco trussed rafters with spans from 20 to 50 feet; sawn timber trusses spanning from 25 to 100 feet; and laminated trusses with spans to 120 feet.

Types of timber trusses detailed in the book are Belgian, Pratt, Howe, Fink, sawtooth, and scissors. Specifications and materials list accompany each typical design.

Distribution of "Typical Designs of Timber Structures" is restricted to architects, engineers, and instructors in architectural and engineering colleges, to whom copies will be sent, without charge, on request to Timber Engineering Company, 1319 18th Street, N.W., Washington 6, D. C.

Cloud-Behavior Study Advanced

A better understanding of cloud behavior is expected to result from a newly developed high-speed electronic device.

The instrument—called a Cloud Particle Counter—has been developed for the Geophysics Research Directorate of the Air Force by Armour Research Foundation of Illinois Institute of Technology, Chicago.

The device automatically samples and measures the minute moisture particles of which clouds are formed, according to Dr. E. H. Schulz, assistant director for research operations at the Foundation.

The instrument makes it possible to measure and count the particles at the rate of 12,000 per minute—several hundred times faster than by the usual method of collecting the particles and examining them under a microscope.

Developed by the fine particles section in the ARF chemistry and chemical engineering research department, the particle counter will aid the Air Force in making meteorological studies, according to the project leader, Dr. Sidney Katz, senior chemist.

Katz said the machine also is capable of measuring microscopic airborne particles such as germs, dust, smog, moisture, and pollen.

Particles ranging in size from 1 micron (40 millionths of an inch) to 64 microns are counted and measured by the instrument.

Development of the counter stemmed from earlier research performed at the Foundation on the design of the aerosoloscope for the Army Chemical corps.

Developed for the Cloud Physics section, Geophysics Research Directorate of the Air Force Cambridge Research center, Boston, Mass., the device is designed to assist in understanding the complex phenomena associated with cloud formation and stability, Katz explained.

Size distribution and stability of cloud particles, he said, are parameters that must be understood to comprehend cloud behavior. It is desirable that the instrument be capable of rapid operation, especially when transient or short-lived phenomena are being studied.

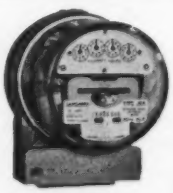
Here's how the cloud particle counter operates:

Droplets are withdrawn from the cloud formation and passed in a narrow stream through an optical system. The droplets are diluted in such a way that each particle is illuminated for a fraction of a millisecond, and the light scattered by the particle is detected by a sensitive photomultiplier.

Since larger particles scatter more light than small ones, the photomultiplier tube, in conjunction with other electronic equipment, can determine the size of each particle. Electrical impulses created by the photomultiplier tube when it detects the scattered light are transmitted to a set of six dials.

The instrument operates at sufficient speed to eliminate errors due to particle agglomeration, evaporation, or condensation. The registered data give a continuous record of the cloud particle concentration and size distribution at the time of measurement.

Katz pointed out development of the instrument is another successful illustration of the "Armour Plan" in operation. Under the plan, specialists from various ARF research departments are used ac-



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cording to the needs of a particular problem.

In addition to the chemistry department, the ARF physics and electrical engineering research departments played major roles in the development of the counter.

Physics developed the optical system, while electrical engineering solved the electronic problems. The chemistry and chemical engineering department had charge of the aerosol handling phases of the project and also coordinated the work of the other contributing departments.

Industrial Research To be Examined

Industrial research — its motives, its management, and its results—will undergo examination at the first annual National Industrial Research conference.

The conference, sponsored by Armour Research Foundation of Illinois Institute of Technology, will be held April 18 and 19 at the Sherman hotel in Chicago.

Purpose of the conference is to provide a forum where common problems of industrial research can be discussed at a management level, pointed out conference chairman Dr. Haldon A. Leedy, director of the Foundation.

"The need for such an annual meeting is reflected in the increasing importance of, and expenditures for, research and development," he said.

"Research for Profit" has been selected as the theme for the two-day conference.

Twelve papers will be presented at three half-day sessions, two luncheon meetings, and a dinner meeting at the Sherman Hotel.

The opening day morning session will deal with the record of profitable research and will include addresses by representatives of a large corporation, a medium-sized company, and a trade association.

Research management discussions will be covered in the April 18 afternoon session, with papers on the value of basic research, the use of outside research facilities, and a review of the results.

A session relating to how the typical stockholder, company, and researcher regards research will be held in the morning on April 19. Special tours, if desired, will be conducted at Armour Research Foundation. Exhibits will be on display at the hotel.

Included among the luncheon addresses will be a talk by a government official on industry's stake in defense spending.

The two-day conference will be open to all industrial executives interested in the management of research and development.

Further information about the conference can be obtained by writing to Joseph J. Kowal, conference secretary, Armour Research Foundation of Illinois Institute of Technology, 10 W. 35th street, Chicago 16, Ill.

Trucks Get the "Eye"

An infra-red "cateye" by which spotters 30 feet off the highway can identify truck license plates is now operating on the Pennsylvania Turnpike as a means of curbing truckers who violate the speed limit, points out *Engineering News-Record*. Instrumentation is adapted from navy signal equipment. The "trap" in this case is a form of self-policing because it is operated by the state's motor truck association.

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Plastics May Replace House, Car Materials

Plastic automobiles and houses are "just around the corner," according to a noted chemical engineering educator and researcher.

"Plastics will be lighter, less expensive, and in many cases more desirable than the materials now being used," explained Prof. Vasili I. Komarewsky of Illinois Institute of Technology.

He pointed out that the public already is using synthetic tires, plastic furs, and artificial fabrics.

"There is every indication that a great many more products traditionally made of natural materials will be available in plastics in the near future," he said.

Komarewsky stated that one-piece plastic automobile bodies already are in the final stages of development and should be on the road in a few years.

"The molded plastic bodies not only will be lighter and more economical, but just as safe as present steel bodies."

One of the features of plastic automobile bodies will be their resistance to damage, he said.

The plastic may give with the impact of a blow, but it will return to its former shape after the pressure is released, Komarewsky asserted.

House construction is another area in which Komarewsky expects plastics to assume great prominence. He said that plastics conceivably could replace most of the natural building materials used in a home today.

"Because plastic building materials will be designed to go together easily, labor costs—a large part of the expense in building a house—will be lowered considerably."

Komarewsky also looks for major advances in chemical engineering when atomic energy is available as an inexpensive power source.

"With cheap atomic power we can take advantage of mineral resources that have been known for years but have been too costly to extract," he said.

Komarewski mentioned the sea as the largest and most available source of mineral resources.

"Some day our entire mineral industry will be centered around the sea. We will extract needed minerals from sea water as we now obtain much of our magnesium and bromine," he said.

C. T. A. Continues Modernization

Five hundred and forty-three rapid transit and surface units delivered, ordered or authorized, and the completion and opening of a new operating station, Forest Glen, highlighted 1955, the first year of CTA's second five-year modernization program, Walter P. McCarter, CTA general manager, announced Jan. 3.

New vehicles received during the year and now in service are 99 L-P gas (propane) buses and 114 rapid transit cars. On order are 80 more rapid transit cars, and authorized are 150 buses, as well as another 100 buses on a rental basis. Total cost of all new equipment received, ordered, or authorized during the year is $12,040,000—$4,980,000 for new buses, and $7,060,000 for "Green Hornet" rapid transit cars. There are now 470 "Green Hornet" rapid transit cars in service.

Contemplated for purchase in the near future are 250 rapid transit cars, which would complete the modernization of the rapid transit fleet.

Since the start of CTA's modernization program, according to McCarter, more than $102,000,000 has been invested or committed for purchase of modern rolling stock, in the modernizing of other equipment and for other facilities.

Altogether, 3,915 buses and rapid transit cars have been purchased, or have been authorized for purchase and rental, in what has been generally recognized as one of the most extensive modernization programs in the transit industry today, McCarter stated.

One of the features of the year's equipment program was the development of high-performance rapid transit cars, proved capable of traveling at 76 miles per hour in a speed run made Oct. 3. These cars are being considered for future operation in expressway rapid transit facilities and are the forerunners of more convenient and speedy transit service.

In line with the adding of new equipment was the completion and opening, on Dec. 4, of CTA's third modern bus station, Forest Glen, at Elston and Armstrong aves. The $2,500,000 facility provides servicing and overhauling facilities for motor and trolley buses of 12 northwest side routes.

To attract more rapid transit riders, CTA placed in operation its new Park 'n' Ride lot at the Kimball and Lawrence terminal of the Ravenswood "L" line. Use of the facility, which has room for approximately 130 automobiles, is growing steadily, and is the first CTA lot where a parking fee is charged. CTA Park 'n' Ride lots now have a total capacity of 940 automobiles, and all are used extensively.

With the addition of new equipment and improvement of service, patronage of the traffic-free rapid transit lines showed a one and one-half per cent increase in 1955 as compared with 1954. A slackening of the downward trend in overall CTA riding—only two and one-half per cent below the 1954 total—also was noted.

Meanwhile, CTA generally held its own on the financial end, McCarter said. Income for 1955, he stated, will at least equal fixed financial requirements, although higher expenses are foreseen for 1956. Partially responsible for the 1955 income level is a considerable saving to CTA — approximating $1,500,000 per year — resulting from legislation exempting CTA from the payment of motor fuel tax.

Further economies were achieved by advance bond retirements which effected savings of $1,141,689 in 1955, bringing to $3,058,160 the total savings in principal and interest by advance retirements of $2,909,000 maturity value of CTA revenue bonds.

CTA's year-round safety program has paid off, with the frequency of traffic accidents 11 per cent below that of 1954.

The Courtesy Caravan, a system-wide program for increased courtesy and improved service, was inaugurated in May and is continuing. Undoubtedly, the substantial decline in the number of service and other type of complaints, and an appreciable increase in the number of commendations, are due largely to the Courtesy Caravan program.

CTA also participated in a nationwide contest seeking ideas for the "Bus of Tomorrow" and offering $2,000 in prizes to CTA personnel. At years end, employes' entries in this contest were being judged. The prizes were awarded during January.

British Put Accent on Power Research

The British Central Electric Authority which is responsible for generation and distribution of 90 per cent of the public power in England and Wales, spends from half million to one and a half million pounds annually on research, it was reported Feb. 1 at the Winter General Meeting of the American Institute of Electrical Engineers at the Hotel Statler in New York.

This amount, reported J. S. Forrest, director of the Central Electricity Research Laboratories, Leatherhead, Surrey, England, includes research by the Authority, cooperative research, external research and development projects such as gas turbines, flue washing, and high temperature steam plant.

Research and development work includes generation, combustion, corrosion in boilers, steam temperature measurements, condenser tubes, boiler feed-pump gland seals, water cooling towers, fly-ash, turbo-alternators, future energy requirements, transmission and distribution, high voltage transmission, insulators, conductors, lightning, switchgear and

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transformer insulation and transformer noise.

As to the latter, Forrest reported:

"With the development of the electricity system and the extension of built-up areas, it is inevitable that transformers are more likely to be situated in close proximity to dwelling-houses. The problem of transformer noise is therefore becoming more serious. Complaints of noise are particularly difficult to deal with partly because of the sensitivity of the human ear (it is seldom possible to measure the noise at the position where the complaint is made,) and partly because psychological factors are often of importance. There is scope for research on fundamental methods of reducing transformer noise, but it was considered that, from the Authority's point of view, the first step should be to make measurements of the noise emission from transformers of various sizes, and also to obtain data on the attenuation of noise with distance and the effect of screening walls or complete enclosure of the transformer. This work has now been completed and information is available to enable the sound level at a dwelling-house to be estimated in a particular case."

Logistics of Oil Products Impressive

A single day's shipments of oil products in 1956 would fill 18,100 miles of ten-inch product pipeline and it would take 378 trains, each of 100 tank cars of 10,000-gallon capacity, to move one day's petroleum demand by rail, reports *Petroleum Processing*. Total demand at U. S. refineries for all products in '56 will reach a new high of 9,009,000 barrels-per-day, according to the magazine.

State to End "One-Shot Economy"

The "one-shot economy" of Eastern Kentucky's coal-mining area may be relieved as a result of a $55,000 study to be conducted by three nationally-known research organizations.

Armour Research Foundation of Illinois Institute of Technology, Chicago, has been contracted by the State of Kentucky to make a preliminary study to determine what resources might be developed to alleviate the region's dependence on coal.

If the initial study shows promise, two other research organizations—Resources for the Future, Inc., and the National Planning Association—will work with the Foundation to find a solution to the problem.

Armour Research Foundation will proceed with a complete technological audit of the region, including economic aspects of any new products or processes being considered for the area, according to Dr. Haldon A. Leedy, ARF director.

"Purpose of the audit," Leedy said, "would be to determine the possibility of developing new industries which would lead to a more stable and prosperous economy."

At present, Eastern Kentucky depends entirely on coal-mining for its economy, it was pointed out by Niels C. Beck, assistant manager for program development at the Foundation.

Economic considerations such as employment, markets, and competition would be coordinated with the Foundation's technological survey by Resources for the Future, Inc., Beck explained.

The National Planning Association will provide assistance in local development of the program when the study has been carried far enough to have reasonable expectation of useful results, he said.

The project was framed at a conference Dec. 29 in the office of Gov. A. B. (Happy) Chandler. Meeting with the governor were Beck, Dr. R. G. Gustavson, director, Resources for the Future, Inc., and John Miller, executive secretary, National Planning Association.

Eastern Kentucky capitalists, high officials of the coal industry, and economic consultants of the state also were present.

The Kentucky Coal Operators Association is cooperating with the three research organizations on the project.

Resources for the Future, Inc., is a non-profit corporation established with the cooperation of the Ford Foundation to improve the development, conservation, and use of natural resources primarily in the United States.

The National Planning Association, headed by H. Christian Sonne, is a non-profit organization established in 1934 to bring together leaders from agriculture, business, labor and the professions to pool their experience and foresight in developing workable plans for the nation's future.

Armour Research Foundation operates as an independent applied research organization which covers virtually the entire field of the physical sciences.

Car Paint Dries Fast

Freshly painted automobiles in a repair garage now can dry in 30 minutes in a 96-kilowatt far-infrared drive-in oven, reports *Electrical World*. Drying formerly took seven-and-a-half hours in a dust-free atmosphere.

By the Light Of the Silvery Moon...

An old superstition among certain natives of Central and South America is that mahogany trees should be cut by the light of the moon because, according to this theory, they're sounder, freer of sap and of a richer color at night than during the day. Actually, the National Lumber Association says, this belief has no basis in fact.

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CRERAR LIBRARY
News and Notes

A "Conference on the Practical Utilization of Recorded Knowledge—Present and Future," held at Western Reserve University, Cleveland, Ohio, January 16-18, was attended by three members of Crerar staff, Librarian and Mr. Ammiel Prochovnick and Miss Muriel Kolinsky of Research Information Service. The program of the Conference had a high degree of relevance to the interests of Crerar Library. Mr. Henkle served as co-moderator of the panel discussion, "The Role of Recorded Information in the Decision-Making Process." Participants in the panel represented Case Institute of Technology, Allied Chemical & Dye Corporation, Southwest Research Institute, Massachusetts Institute of Technology and the National Bureau of Standards. Topics discussed were Management Needs of the Future, Operations Research Approach, Recorded Information in Chemical Research, Information Theory in Automation of Retrieval of Recorded Information, and Machines for Retrieving and Correlating Recorded Information. Other panel discussions were devoted to cooperative information processing with special reference to publication of abstracting service, a program for education of librarians and documentalists, and the role of language in the communication of recorded information. Mr. Prochovnick, Mrs. Kolinsky and Mr. Henkle, respectively, represented Crerar Library in three special conferences on Cooperative Abstracting in the Field of Metals, Cooperative Pharmaceutical Abstracting, and Cooperative Documentation Information Processing. The general conference was attended by some 575 representatives of industry, government, research institutes and libraries.

* * *

A detailed report on book and periodical expenditure has just been prepared for the calendar year 1955. The following figures will be of interest to WSE members; they do not, of course, indicate total library costs, but represent book and periodical expenditures in selected fields:

Physics	$ 3,726
Chemistry	11,108
Geology	1,357
Gen. Biology	1,616
Botany	735
Zoology	1,877
Engineering	7,245
Agriculture	1,151
Manufacturing	1,626
Construction	399

* * *

A new offset printing press was added to the Library's equipment in January. The Davidson Model 233 was acquired primarily as part of the project for publishing the catalog of the Clifford G. Grulee collection on pediatrics. Experience will be gained in the use of the press on a variety of printing jobs, which will make possible more efficient handling of the Library's publication program.

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Reviews of Technical Books

Machine Design

Machine Design, by Paul H. Black, McGraw-Hill Book Company Inc., New York 36, N. Y. Second edition. 1955. 471 pages. Price $7.50.

A basic work, this book is intended to serve as a textbook for courses in general machine design and as a reference book in mechanical-design offices.

Black has used the analytical method, combined with results of experimental investigation. He uses the empirical method only when it is impractical to use the analytical approach. The student is constantly kept in mind. Special attention is given to approaches, assumptions, explanations, and special considerations and applications. He maintains a rational approach to the subject and provides a logical, understandable treatment of modern practice.

This new edition contains fuller explanations of principles; this is shown, for example, in the addition of worked-out examples. It includes additional applications, and the coverage of the field has been broadened by treating more fully the selection of material, types of power-transmission units, motor selection, and other phases of comprehensive applications. Standards have been up-dated; this includes those for screw threads and ratings of power-transmission chains and V-belts and gears, as well as new codes and practices.

This has been done in the hope that students will be able to design safer, more economical, and more efficient machines. The latest authoritative treatment of stress concentration is given, and many new figures and photographs have been added.

Paul H. Black is a professor in the department of mechanical engineering at Ohio University. He has also been an instructor at Illinois and Cornell. He was previously associated with Westinghouse Electric Corporation as an engineer. He is especially known for stress analysis, lubrication, machinery and equipment, investigation of stresses in gears, and notes on machine design.

R.G.G.

Diesel Engineering

Diesel Engineering Handbook, edited by A. B. Newell, Diesel Publications, Inc., New York 16, N. Y. Ninth edition, 1955. 835 pages. Price $8.50.

Unchanged in basic character, this book, written as a reference guide for the beginner, or the expert, in the Diesel industry, has been completely revised. The new ninth edition is comprehensive and up-to-date; it covers the latest innovations in Diesel engine design, maintenance, and operation.

Newell, a veteran of forty years' experience in the operating, manufacturing and publishing phases of the Diesel industry, states that the Diesel engine continues to employ Dr. Diesel's original theory of the high compression internal combustion engine, and any book on the subject of such engines must, therefore, conform to an earlier pattern if that pattern was good.

But, with the rapid increase in the use of Diesels in automotive, as well as many other fields, new chapters have been added. These include many new engine specifications devoted to light-weight, high-speed Diesels.

Also, the Handbook has an increased coverage of Heavier Diesels; those that are used in marine, power plant, and railway operations. Emphasis is placed on fuel and lube oil efficiency and economy.

There are thirty chapters, in which nine-hundred separate Diesel subjects are reviewed; these are illustrated by five-hundred-and-eighty-one fine photographs and drawings.

The Handbook should continue to be one of the most popular books that deal with the Diesel in its many uses.

R.G.G.

Tool Design

Tool Design, by William R. Jeffries, Prentice-Hall, Inc., New York 11, N. Y. 1955. 217 pages. Price, $6.35.

Written for the purpose of providing a survey of the tool design field, this book should be invaluable to readers who have no previous knowledge of tool design, but are familiar with common machine tools and manufacturing processes.

Jeffries has made a compilation of his notes, which were collected during the years of teaching tool design to college engineering students. He has arranged his material so that it may be presented in college and technical classes. But, he has kept the general reader in mind, and it is his hope that this will lead to informal study. However, he states that the most nearly perfect design in the world will fade into oblivion if the object cannot be offered for sale at a price that consumers are willing to pay.

So he includes the two departments of prime concern to the engineering student; these are known as *Tool Planning* and *Tool Design*. He suggests that the greatest asset, along this line, is for the technical graduate to familiarize himself with shop work, and its problems, and progress from there.

Fundamental principles are stressed. These principles are illustrated and actual instructions are given for the designing of machine tool jigs and fictures. Easy-to-follow details for weld and assembly fictures, punch press tooling, and hydraulic press tooling are also included in this simple text, which is devoid of needless technical expression. His book is well-illustrated, so that each particular procedure is carried out at the same time as it is described.

William R. Jeffries taught tool design and machine shop for eight years at Montana State College. He has had industrial experience with the Douglas Aircraft Company, where he supervised jig, ficture, die and general tool design.

R.G.G.

Advantages of Wood Windows Cited

It's fine to "bring the outdoors indoors" in modern house design, but experienced home owners have learned that it's a good idea to keep some control over the process.

Therein lies a main reason for the continued preference for wood windows in new American homes, according to Leo V. Bodine, executive vice president of the National Lumber Manufacturers Association.

"Wood windows give maximum protection against cold, drafts and condensation in winter and against heat in summer," Bodine said. "It is significant that the latest Bureau of Statistics survey shows a rising trend in use of wood windows in the Northeastern and North Central states.

"Because of their longer, colder winters, home owners in these areas of the country traditionally have been known to demand the best in windows, for greater comfort and for house heating economy. The recently published BLS survey, which covered one-family houses started in the first quarter of 1955, showed that 68 per cent of all windows were framed with wood in the Northeast and 63 per cent were framed with wood in the North Central states.

"For the country as a whole, nearly six out of every ten windows were framed with wood in the new houses.

"Wood windows not only led in all regions of the country but also in all sales price brackets, from the least expensive to the most expensive houses."

The double-hung wood window is still far in the lead of all other styles but other types of wood windows, including awning and horizontal slide, are increasing rapidly in use, according to the BLS survey.

Modern wood windows have "finger tip" operation, Bodine pointed out. Spring balances are replacing sash weights and cords. Frames, sash, weather stripping and hardware are manufactured as complete units for ease of installation and exact fit, Sash can be lifted out for cleaning. Available are windows that can be installed in any one of three positions: awning, hopper and casement.

"These new-fashioned methods of manufacture have much to do with the continuing preference for wood windows but the old-fashioned virtues of wood itself are important factors," Bodine said. "Wood has a natural affinity for home furnishings and is unsurpassed in improving exterior home appearance. Wood window frames are easy for the housewife to drape or curtain and they do not rust or corrode. Wood windows can be easily adjusted in the event of minor settlement of a house. Frames are not subject to permanent distortion. But perhaps the main appeal of wood windows continues to be their draft-defying snugness and protection against heat, cold and condensation in an age when we have opened up our homes for more light and view but still want to keep the weather out a great many days of the year."

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Civil Engineering Department Set Up

A full department of civil engineering has been set up at Saint Louis University's Institute of Technology with John F. McCarthy as director, it was announced Jan. 13 by the Very Rev. Paul C. Reinert, S.J., president of the university.

Civil engineering was introduced at the school four years ago, but in its early stages has been operated through the department of engineering. The Institute of Technology has departments of electrical, geological and geophysical engineering in addition to civil.

McCarthy, whose appointment was effective Jan. 1, joined the faculty last year. Before that he was a chief structural engineer with the W. R. Bendy Consulting Engineers. Earlier he had held the same position with the Fruin-Colnon Contracting Company. McCarthy received his master's degree in 1950 from Missouri School of Mines, Rolla, Mo., where he also completed his undergraduate work. He was a member of the faculty there from 1948 to 1951.

The Institute of Technology was founded in 1944. Through it the University offers programs in most of the fields of engineering, with aeronautical engineering given at the University's Parks College of Aeronautical Technology in Cahokia, Ill.

The Institute's present enrollment is 413 students. The university's long range development program is preparing for a buildup to 1,500 students in the foreseeable future. One of the highest priorities in the $41,600,000 First Stage of the program is a new building for the Institute on the North Grand Campus of the University.

Device Devours Fuel

The ROR — rocket-on-rotor — device to improve lift of helicopters requires 300 pounds of fuel for six minutes of operation, according to *Aviation Week*.

WSE Personals

Miss Lillian Stemp, MWSE, was elected chairman of the Printing and Publishing Section of the National Safety Council at the last National Safety Congress. She is the first woman to be elected general chairman of a section other than the Occupational Health Nursing Section which is made up solely of industrial nurses. Miss Stemp wrote the "Safety Manual for the Graphic Arts Industry" which is accepted as the most authoritative publication in the field of Graphic Arts Safety.

* * *

Cecil J. McLean, MWSE, has been elected president of the Illinois Section of the American Society of Civil Engineers. McLean is general hydraulic engineer with the Commonwealth Edison Company.

Harold F. Sommerschield, MWSE, was elected vice-president of the section, and Paul Rogers, MWSE, was elected secretary. Sommerschield is a partner in the firm of Suter & Sommerschield. Rogers is head of the firm of Paul Rogers & Associates. He is also lecturer in civil engineering at the Northwestern Technological Institute.

* * *

E. A. Schmidt, MWSE, midwest regional manager of the I-T-E- Circuit Breaker Company, announces the appointment of Merlin J. Adams to the position of Chicago district manager.

* * *

Kenneth W. Hamming has been admitted to the partnership of Sargent & Lundy, Chicago consulting engineering firm specializing in steam power station design. Hamming received his engineering degree from the University of Illinois in 1940. He joined the mechanical engineering staff of Sargent & Lundy the same year. His association with the firm has been continuous except for a brief absence during World War II.

Richard N. Bergstrom, MWSE, and Max Zar, MWSE, have been appointed associates in the firm.

* * *

O. A. Hill, MWSE, has been elected president of the Chicago Lighting Institute. He is superintendent of the Light Bulb Service of Commonwealth Edison Company. Among other officers elected for the coming year are Frederick H. Heintz for vice-president and R. J. Diefenthaler, secretary-treasurer.

* * *

J. R. Meehan, MWSE, vice-president of Fischbach, Moore & Morrissey, Inc., has advised that the firm's new address is 173 West Madison street, Chicago 2. The new telephone number is RAndolph 6-9229.

Theodore von Karman, senior scientific adviser on aeronautics to NATO and the United States Air Force, has been named a director of Gruen Precision Laboratories, Inc., newly formed subsidiary of the Gruen Watch Company of Cincinnati. The announcement was made by Edward H. Weitzen, president of the 80 year-old parent corporation. An internationally known authority in aerodynamics, Dr. von Karman will participate actively in Gruen Laboratories as chief of the Planning Board.

Known as the man who exercised the greatest influence in the development of high speed aircraft in the United States, Dr. von Karman holds two key positions in the Western World's air defense system. He is chairman of the aeronautical research and development group of NATO and chairman of the United States Air Force's scientific advisory board. In 1954, he was awarded the Wright Brothers Memorial Trophy for his contributions to the science of aeronautics.

As director of the Guggenheim Aeronautical Laboratories at the California Institute of Technology, Dr. von Karman built one of the world's outstanding aeronautical research centers.

In 1938, at the request of General Arnold, wartime chief of the Air Force, he undertook leadership of the Army Air Force's first jet propulsion and rocket motor program. His concepts led to starting research on the Bell X-1, first plane to break the sound barrier.

Prior to World War II, Dr. von Karman proposed to the Ordnance Department of the Army that supersonic wind tunnels be utilized in ballistics research. His work from 1940 to 1942, in developing a model supersonic wind tunnel at California Institute of Technology, led to the design and operation of the ballistics wind tunnel at Aberdeen Proving Grounds. He has been a member of the scientific advisory committee of the Ballistics Research Laboratory at Aberdeen since 1940.

In 1944, the Air Forces named Dr. von Karman director of its scientific advisory group and special consultant to General Arnold.

As a delegate from the United States, Dr. von Karman attended the Fifth Volta Congress in Italy in 1935 and there presented the first theory of air resistance of bodies moving at supersonic speed. This theory is now known as the Karman Vortex Trail.

Among the awards bestowed on him in addition to the Wright Brothers Trophy have been the American Society of Mechanical Engineers Medal, 1941; The Sylvanus Reed Award of the Institute of Aeronautical Sciences, 1941; the Medal for Merit, 1946; the Legion of Honor, 1947; the John Fritz Medal, 1948; the Kelvin Gold Medal, 1950; and thirteen honorary degrees from American and European universities.

Dr. von Karman has held the post of lecturer at leading universities in the

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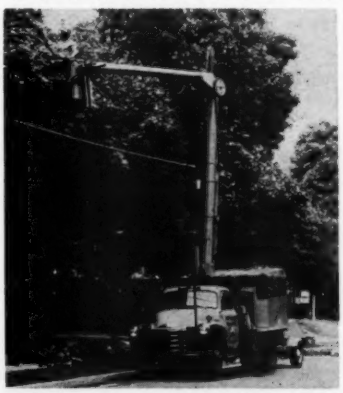

United States, Europe and Asia. He is currently a member of most of the world's leading academies of science. Writer and editor of many books and articles, his most recent example is *Aerodynamics,* published by Cornell University in 1954.

* * *

Robert B. Jordan, MWSE, has been appointed chief engineer, engineering department, of Universal Atlas Cement Company. He first worked for U.S. Steel in the construction engineering department of the South Works in Chicago during 1937 and 1938. Universal Atlas is a subsidiary of U.S. Steel. Jordan rejoined the construction department of the South Works in 1940, and in 1946 was promoted to the position of chief construction engineer. He became assistant chief design engineer in 1951, and, later in the same year, was appointed assistant chief construction engineer, at the Fairless Works in Morrisville, Pa., where he was in charge of construction for all sheet, tin, and rolling mill facilities. He joined Universal Atlas in 1953 as assistant chief engineer. Jordan, who was born in Chicago, attended the University of Illinois, and was graduated from the Illinois Institute of Technology.

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Sweden to Use Atom Power for Electricity

Sweden is planning to use atomic power to supplement its electric supply, it was announced in New York on Feb. 1. at the Winter General Meeting of the American Institute of Electrical Engineers. An atomic thermal station to be started in 1960 is now being planned and an atomic power station with an initial capacity of 100,000 kilowatts, will be ready by 1963, Gunnar Jancke and Ivar Herlitz, of the Swedish State Power Board, told a research symposium in a paper "Research for the Electric Power and Electric Utility Industries in Sweden."

Ninety four per cent of the country's electric energy is produced by hydroelectric stations, with a present annual capacity of 25 billion kilowatt hours, equal to 3,500 kilowatt hours per person. Power use has doubled in the past 11 years.

"The water power suitable for exploitation is assessed at 80 billion kwhr/year," they said. "If the load continues to increase at the present rate, the whole of the available water power will have been developed within a period of 20 years. Even before this stage is reached, however, it will probably be found remunerative to build atomic power stations close to the load centers. At the present time plans are being prepared for an atomic thermal station to be started up in 1960 and an atomic power station with an initial capacity of 100,000 kw which will be ready for service in 1963. Research work relating to the utilization of the peat bogs for electric power production is in progress."

Except for waterpower, Sweden has little natural resources of energy, aside from some low grade uranium and a considerable quantity of peat, they pointed out.

Eighty-five per cent of the hydro power is in the north of the country, while 85 per cent of the population is in the south, necessitating transmission of electric power at high voltages over average distances of 300 miles, they said.

Sweden's electrical industry entails a great deal of fundamental research, much of which is done in the universities, with professors subsidized by the state and industry, the authors said.

A Trip to the Moon Is Offered in Contest

Many companies have taken contest winners to the Caribbean, to Paris and even around the world. Now, finally two cooperating Cincinnati firms are offering a trip to the moon as a dealer contest prize, based on the opinion of experts that space flight is possible in this generation, reports *Electrical Merchandising.* This "out of this world" promotion is aimed at boosting television set sales. If the winner doesn't want to go to the moon, by the way, he can accept $1,000 instead.

Weather Causes Load

Weather accounts for most of the load on air conditioning equipment, but heat radiated by lights and other equipment, as well as human warmth and perspiration, can boost requirements considerably, points out *Electrical World.*

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WSE Applications

In accordance with the By-Laws of the Western Society of Engineers, the following names of applicants are being submitted to the Admissions committee for examination as to their qualifications for admission to membership into the Society in the various grades, i.e., Student, Associate, Member, Affiliate, etc. All applicants must meet the highest standards of character and professionalism in order to qualify for admissions, and each member of the Society should be alert to his responsibility to assist the Admissions committee in establishing that these standards are met. Any member of the Society, therefore, who has information relative to the qualifications or fitness of any of the applicants listed below, should inform the Secretary's office. The Secretary's office is located at 84 East Randolph Street. The telephone number is RAndolph 6-1736.

47-55 Woodrow E. Hoch, President, Master Oil Products Corp., 5308 Harrison St., Skokie, Ill.

48-55 Edmund B. Buster, Sales Mgr.-Metalclad Equip., S & C Electric Co., 4435 N. Ravenswood Av.

49-55 Miss Barbara A. Robinson, Architect; Shaw, Metz & Dolio, 208 S. LaSalle St.

Wild Oats = Fortune?

Wild oats this year will add up to more than a $0.25-billion loss among United States and Canadian farmers, reports *Chemical Week*. This costly weed has already spread across 60 million acres of the spaded plains like a prairie fire and is responsible for a greater reduction in farm income than any other weed. With farmers willing to pay up to $10 an acre for the needed chemical pesticide, a $600-million market waits for any company that comes up with a formula that ran really un-sow the wild oats.

Coal Found Under Sea

The first major out-to-sea boring ever to be carried out in the United Kingdom has proved successful, reports *Coal Age*. After drilling five months the National Coal Board has struck coal 2,000 feet below the Firth of Forth and about a mile and three-quarters off shore from Kirkcaldy Fife, Scotland.

Higher Voltage-Use Study Is Urged

The electric utility industry was urged Feb. 1 in New York to step up thinking and studies of the utilization of higher voltages for expanding loads in new homes.

This was among seven conclusions made by S. B. Griscom and R. F. Lawrence, of Westinghouse Electric Corp., in a paper, "Residential Distribution—An Analysis of Systems to Serve Expanding Loads," presented at a session on transmission and distribution at the Winter General Meeting of the American Institute of Electrical Engineers at the Hotel Statler.

The authors emphasized that the opinions they expressed about any change from the traditional 120/240 residential service in use in this country for many years were their own and summarized their study as follows:

The electric utility industry should accelerate their thinking and their studies of residential distribution to the end of determining now whether a new fundamental plan of distribution is desirable for expanding loads.

The industry (for example, by joint committees) should very carefully study the question of the feasibility of higher distribution secondary voltage from all angles to determine whether some of the anticipated drawbacks are real or imaginary.

An industry study should be made of mass-produced motor-driven appliances up to 15 h.p. for use in residences. The study should encompass motor and distribution system performance and costs to the end of determining whether single-phase or three-phase motors best reconcile the requirements of all parties concerned.

In the event that the answer to 1 is in the affirmative, every effort should be made to reconcile all viewpoints to the end that the new system be reasonably satisfactory to all, such that only one new standard would be involved, and it would have the prospect of being as long-lived as the present standard has been.

It is the authors' opinion that substantially-improved economy can be obtained by increasing the distribution system voltage, and that an approximately double voltage will suffice.

It is the authors' opinion that a three-phase, four-wire distribution system with voltage in the general level of 265/460 volts is more economical than any other candidates. It is presumed that autotransformers would be used to serve lighting and run-of-mine small appliances."

Service Stations Are Now Prefabricated

Prefabricated service stations are popping up in increasing numbers, reports *Petroleum Week*. It's expected that at least 700 will be put up in 1956. They cost around $12,000 and can be assembled in about 14 days, thus giving them a head start on sales at a new outlet.

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Work at Air Academy Is Now Accelerating

Construction of the U. S. Air Force Academy, now confined largely to preliminary development of the utilities system, is expected to be in full swing by the latter part of 1956.

Col. Albert E. Stoltz, director of the Air Force Academy Construction Agency, has announced that construction of the cadet quarters and the academic buildings will begin sometime during the fall of the year. Contract for clearing and grading the area, and for construction of the retaining walls and foundations of the academic area will be awarded in March.

Three contracts early in the year lead off the construction schedule. Full scale mock-ups of two cadet quarters rooms will be built, followed by contracts for the heating plant equipment and grading and drainage of the second increment of roads in February.

Roads continue to dominate the early phases of the construction program, according to the schedule released by Col. Stoltz. Nowers Construction Company of Pueblo is now completing the first segment of nine miles, and is ahead of schedule on its work. The second road system will include more than fifteen miles. A third increment will begin in April, with a fourth contract expected to be awarded in midsummer of 1956.

Bids will be opened in April for an electrical and communications system for the Air Force Academy site, the schedule announces. The May construction program calls for awarding of contracts on bridges, sewers, gas and heating mains, followed by construction of a sewage treatment plant starting in June.

First actual construction of buildings, other than the models for the cadet quarters, will be that of the service and supply area to be built approximately two miles northeast of Breed underpass between the Santa Fe and Denver and Rio Grande railroads. This complex will include warehouses, storage buildings, automotive repair shops, and air installations offices.

Rayon is Fifty

Rayon, one of the thousands of products made from wood, was first manufactured commercially more than 50 years ago.

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Many Executives Attend Meeting

More than 500 industrial and business executives were in attendance at the Industrial Economics Conference held in Los Angeles, Jan. 30-31.

Taking place in the Statler Hotel, the conference was sponsored by Stanford Research Institute and was of special interest to general management, sales managers, research directors, company planning and development executives, industrial economists and other industrial and professional men concerned with organizational long-range planning.

Don G. Mitchell, chairman and president, Sylvania Electric Products, New York; J. Peter Grace, Jr., president, W. R. Grace & Co.; and Gerhard Colm, chief economist, National Planning Association, delivered addresses at two luncheons and a banquet scheduled during the two-day conference.

Mitchell delivered a speech entitled "Technological Frontiers" at luncheon on January 30 while Grace delivered a speech entitled "Dynamics of Industrial Planning" at a banquet on the same day.

Colm spoke on "Technology and Economic Progress" at luncheon on the second day of the conference.

During regular sessions of the conference, attendees considered aids for corporate planning, modern market research techniques, operations research, high-speed electronic data processing and improved forecasting methods.

Speakers on Monday, Jan. 30, included: Weldon B. Gibson, director of economics research, Stanford Research Institute, "Guideposts for Forward Planning"; Robert C. Tait, executive vice-president, Stromberg-Carlson Division, General Dynamics Corporation, "Planning for Company Expansion Under Today's Conditions"; Hugh Clary, president, Clary Multiplier Corporation, "Long and Short-Range Planning—A Personal Experience in Company Growth."

Also, Hall L. Hibbard, vice-president for engineering, Lockheed Aircraft Corporation, "Development Planning in the Aviation Industry"; George L. Parkhurst, chairman of the board, Oronite Chemical Company, and vice-president, Standard Oil Company of California, "Long-Range Planning in the Chemical Industry"; and Dean O. Bowman, coordinator of long-range planning, Crown Zellerbach Corporation, "Elements of Corporation Planning."

Tuesday speeches were delivered by Marvin Bower, managing partner, McKinsey & Company, "Building Present and Future Management"; Thomas H. Vaughn, vice president, Colgate-Palmolive Co., "The Growth Factor in Research Planning"; and J. W. Corbett, vice-president, system operations, Southern Pacific Company, "Planning Operations."

General chairman of the conference was P. J. Lovewell, assistant director, Stanford Research Institute.

Chromatic Trucks

The color craze has hit trucks, according to *Fleet Owner*. Black, until recent years about the only available color for trucks, now is offered by only one truck manufacturer, and then only on special order.

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End Is Seen for Cement Shortage

The cement shortage should end in 1957 for most areas unless the present boom-level increases substantially, predicts *Engineering News-Record*. The portland cement industry is now midway in an unprecedented expansion program destined to increase capacity by 25 per cent from the 1954 level.

Annual capacity of portland cement mills is expected to reach 366,000,000 barrels by the end of 1956, the magazine estimates on the basis of a survey of industry plans. Capacity at the end of '55 is estimated at 320,000,000 barrels, compared to 298,000,000 barrels in '54.

The industry's bold new expansion program calls for 23,000,000 barrels of new capacity into production by the end of '55, and a still more ambitious increase for 1956—about 56,000,000 barrels of new capacity.

By the end of '56 capacity in the clinker stage when material is one step away from the final grinding into cement is expected to be 368,000,000 barrels. (In past years clinker capacity has been considered a more realistic measure than finished cement capacity figures, which sometimes are too optimistic.)

The magazine's estimations assume that about 1,000,000 barrels of new capacity, earlier scheduled for this year, will not start until early 1956, and that about 10,000,000 or 11,000,000 barrels of new capacity now scheduled to be producing in '56 will not be ready until '57.

It is certain this huge program, the biggest this year since the 1920's, will mean higher prices for cement, the magazine says. Many companies have announced price boosts for the first quarter of 1956 ranging from 15 cents to 25 cents per barrel. Cement companies do not have enough depreciation reserves available to finance expansion and at the same time keep existing mills in running order, the magazine says. Announced costs on additions to existing plants vary all the way from $2.00 per barrel of annual capacity to $7.50. Figures on new mills run from $5.60 to $12.00.

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— Poor Richard's Almanack

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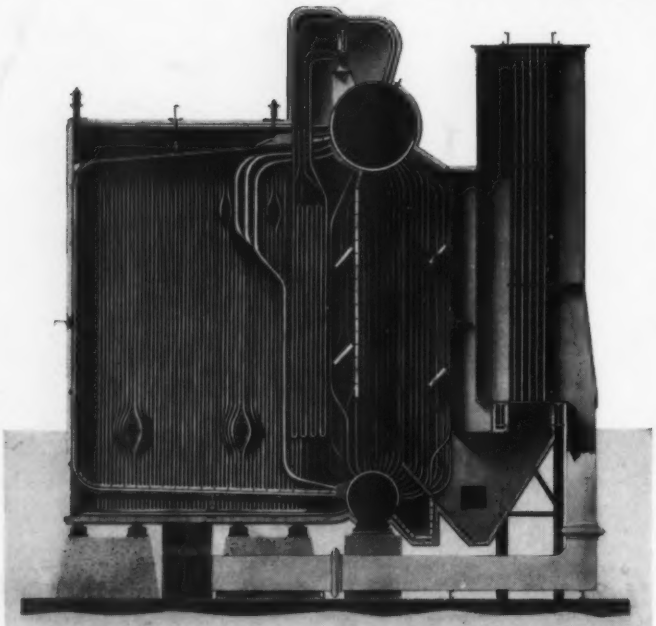

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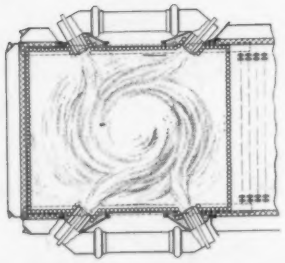
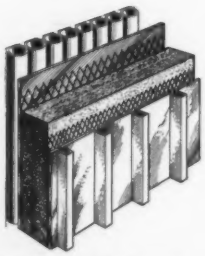
STREAMLINED EXTERIOR. The overall appearance of the VU-55 reflects the efforts of its designers to achieve a completely unobstructed casing, while retaining adequate access wherever required and every facility for convenient operation. There are no outside downcomer tubes, and ducts from air heater to burners are beneath the furnace floor.

Your request for further information on the VU-55 Boiler will receive prompt attention



PLAN VIEW OF FURNACE showing arrangement of burners for tangential firing. Flame streams from the four burners impinge upon one another at high velocity, creating a turbulence unattainable by any other method of firing. The result is rapid and complete combustion. As the gases spiral upward, they sweep all furnace heating surfaces, assuring a high rate of heat absorption.



PERSPECTIVE OF FURNACE WALL. Construction consists of tangent tubes backed up successively by welded steel panels, 4 inches of high quality insulating material and an outer steel casing formed as shown to provide adequately for expansion and assure ample strength. Low heat loss and the tightness required for pressure firing are assured by this welded, double-wall construction.

COMBUSTION ENGINEERING

Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.
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